simple reason, overlooked by von Uexküll, that these anemones are infected by symbiotic algæ.

The effect of wave-action is analysed in a most interesting section devoted to the higher medusæ. The simpler nature of the muscular reflex in Rhizostoma is first explained. It is shown how contraction of the circular muscles of the bell-margin, together with that of the stomach-wall, subserves at once locomotion, respiration, and nutrition. The food of Rhizostoma (Diatoms) is obtained by filtering the sea-water through the minute pores into which the oral aperture is converted. Especially attractive is the contrast in this section between the two allied genera, Rhizostoma and Gonionemus. The first leads a life of one stimulus. The rhythmical pulsation of its bell is its only act, its one stimulus. Gonionemus, on the other hand, though not structurally very diverse, leads a full life. It responds to light and to darkness, to gravity, to chemical and mechanical stimuli. The same world environs each animal: but an organism is, as it were, a wonder-world shut off from this environment, and only the right key opens it. When there is no lock there is no key, and such is the plight of Rhizostoma. Gonionemus has many doors, each with its special key.

From jelly-fish the author passes to the study of sea-urchins, and here he is thoroughly at home, leading the reader through a study of bionomics to an analysis of muscular contraction that is of the greatest importance to physiologists.

Of the author's analysis of the movements of the earthworms, leech, and Sipunculus we have no room to speak, but recommend it to the attention of all physiologically minded biologists; but a word must be said on Jordan's recent work on the locomotion of the mollusc, Aplysia. The body of this creature is enclosed in a muscular sac provided with a thick nerve-network. Each nerve is connected with this diffuse nervous system as well as with the ganglia. The extraordinary thing about the stimulation of this system is that, if the pedal ganglion be stimulated, the effect upon the network and muscular sac is entirely different from that proceeding from the cerebral ganglia. The "brain" inhibits motion; it acts as a brake. These animals, and possibly all Mollusca, resemble such machines as give rise to an excess of steam in all their parts, which excess is allowed to escape by numerous exits. The idea of a group of animals which acts in this way is an entirely novel one.

The further studies on crabs and dragon-flies are of great interest, and we wish it were possible to reproduce their conclusions. Enough, however, has been said to indicate the value of this work. If only the nature of the author's views on reflexes were expressed more clearly we should be inclined to place this book among the most attractive, as it certainly is one of the most illuminating, comparative studies that have appeared. It should appeal to the physiologist and psychologist as much as to the naturalist, and if translated (with a glossary appended) would be eagerly read by a much larger public than will appreciate it in its present form.

F. W. GAMBLE.

SCIENCE AND BELIEF.

Science and Religion in Contemporary Philosophy. By Prof. Émile Boutroux. Translated by Jonathan Nield. Pp. xi+400. (London: Duckworth and Co., 1909.) Price 8*s*. net.

THIS book is an able study of the various attempts which have been made since the beginning of the great scientific movement of the nineteenth century to comprehend science and religion in one system. The writers considered fall into two groups, according as they approach the problem from a naturalistic or spiritualistic standpoint. As representatives of the former M. Boutroux takes Comte, Spencer, Haeckel, the psychologists and the sociologists. The inclusion of Haeckel was perhaps due to his popularity; his dogmatism and inconsistencies are too crude to be worth the attention of an analyst so subtle as M. Boutroux. The discussion of the others might be said to be a discussion of three suggested unifying notions—the notion of humanity, that of the unknowable, and that of fact. The first M. Boutroux finds too narrow, for science refuses to accept an ideal from practical human need, and the essential object of religion is something that is more than man. The concept of Spencer gives liberty at the cost of significance; M. Boutroux shows very clearly that Spencer was led to it by a false standard of knowledge, the standard of pure objectivity, according to which to know the absolute would be to know it as one thing among others. As for the psychologists, who show that the scientific and the religious activities are amenable to common psychic laws, their reconciliation ignores the difficulty, which is the disparateness of the specific ideals inspiring these activities. The sociologists are in no better case; for the given social ends to which they propose to make religion and science both subservient are being by these continually recreated.

M. Boutroux's analysis of the spiritualistic efforts to solve the problem is equally searching. He deals first with the apologists. Some, like the Ritschilians, appeal to immediate internal conviction as the sufficient defence for religion; there are others who, by a criticism of science, show that it is ultimately founded on certain practical beliefs, and contend that science cannot object to religion merely as belief. But the first, since they have discarded all theory, can do nothing but indicate a mere subjectivity, and the second can offer only what appear to be arbitrary beliefs as against the verified hypotheses of science. Next is considered that philosophy which professes to find in activity a principle of unity deeper than the level of our intellectual contradictions, and regards science and religion as complementary but independent expressions of that unity. M. Boutroux points out here a dilemma; if the activity is indeterminate it is without meaning; if it is concrete it returns to us the problem with which we started. Finally, the hypothesis of James that religious experience belongs to the subconscious realm is discussed; the objection is made that the subconscious must be mediated by the conscious, and that hence its import will again be

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conceived under the limitations of ordinary cognition.

The concluding chapter dwells on the relative and symbolic nature of science and its subordination to life; on the insufficiency of human life in itself as an end; on the ideal of duty which summons us beyond the specifically human to a noble struggle and a great hope, an ideal which implies faith and love, which demands a God, and a God with whom we can be in communion. It is in the "living reason" interpreted in the light of duty that science, without which we cannot live, and religion, without which we do not wish to live, find their reconciliation. It must be admitted that this chapter, fine as it is, could not endure the rigorous logic which M. Boutroux has applied to others. His duty is formal, and though a formal notion may, as he says, be efficacious, that concrete efficacy is psychological; we are no nearer a logical synthesis than we were, say, with the notion of concrete activity. But the failure of this effort at construction does not diminish the success of the book in its main intention of critical estimation. M. Boutroux is, like most French writers, a master in exposition; he excels especially in revealing that natural logic by which a biassed view tends to correct itself, an excellence which indicates both the generous critic and the trained philosopher. Probably no book has been written on the subject which will so well repay the student's attention.

THE CHEMISTRY OF THE SUGARS.

The Simple Carbohydrates and the Glucosides. By Dr. E. Frankland Armstrong. Pp. ix+112. (London: Longmans, Green and Co., 1910.) Price 3*s.* 6*s.* net.

CHEMISTS as well as physiologists will welcome the latest addition to the monographs on biochemistry, for there is no other branch of the subject which has afforded so many brilliant examples of successful synthesis or shed so much light on the intricate problems of enzyme action.

The editors have been fortunate in securing the collaboration of Dr. E. F. Armstrong, who has made a special study of the chemistry of the carbohydrates, and writes with an intimate practical knowledge of his theme. At the first glance through the pages of this volume one receives the impression that the author starts on too high a plane, and assumes an acquaintance with the methods and problems of stereochemistry which the biochemical reader may not possess; but one realises on reflection that if he has to compress into ninety-two pages the substance of a subject upon which volumes have been written, he has determined wisely in concentrating into this restricted space those modern developments of sugar chemistry which are of special interest to the biologist, and in leaving other things to take care of themselves.

It is, no doubt, for this reason that the main attention is directed to the natural sugars and glucosides, and that the artificial products are only touched upon where questions of a more general nature are concerned.

The first two chapters are devoted to the structure and properties of glucose, and are followed by one describing the natural hexoses and pentoses, whilst the fourth contains a description of the disaccharides. The succeeding two chapters contain an account of problems with which the author is more closely identified, and furnish much the most interesting reading. In the first of these the subject of configuration in its relation to enzyme action is discussed, and includes the selective action of maltase and emulsin on the glucosides to which Fischer first directed attention, and the selective oxidation of alcohols and sugars by the *sorbose bacterium* described by Bertrand.

Under "Hydrolysis and Synthesis," in which reference is made to the rate of hydrolysis of the disaccharides by acids and enzymes, the author discusses his stereochemical hypothesis, based on a series of interesting numerical data. Such a hypothesis, which may be tested experimentally, can only enlarge our outlook, and the same may be said of the mechanical similes of templates (p. 71) and glove fingers (p. 58), provided we regard the latter, as Fischer did his lock and key, as similes only and nothing more. The writer would, however, like to raise a mild protest against a fusion of the two ideas which the author makes use of in the formula on p. 58, where the atoms of enzyme and substrate are represented as interlocked, a theory which, on the one hand, can never be tested experimentally, and, on the other, can offer no advantage over the lock and key or other mechanical simile.

On the whole, the subject is well and clearly written, and there is very little with which the critical reader can find fault. Here and there certain passages occur which might be improved by expansion or modification, and in this connection reference may be made to the following paragraphs:—

On p. 66 we are told that the difference in the hydrolytic behaviour of enzymes and acids is "due mainly if not wholly (1) to the superior affinity of the enzymes for the carbohydrates; (2) to the very different behaviour of the two classes of hydrolysts toward water—which is a consequence of the colloid nature of the one and the crystalloid nature of the other." One would like to know more precisely how the "superior affinity" and "colloid nature" act in favour of the enzyme.

On p. 70 the author refers to Fenton's reduction of carbon dioxide to formaldehyde by magnesium as a deeply significant observation when considered in relation to Willstätter's discovery that chlorophyll contains magnesium. Are we to suppose that the magnesium in chlorophyll plays the part of the free metal? If not, what is the deep significance of the observation?

There is a slip on p. 59, where α-carbon atom should be "first carbon atom," and on p. 68, where it is stated that sorbose is derived from mannitol. Xylose is not limited to straw, but is found in most kinds of wood (p. 37). In the separate description of the disaccharides, for some reason not given, three members in table viii. are omitted. On the first page of the introduction the author says, "The members of the sugar group are usually distinguished by names hav-

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